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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/056,747	01/24/2002	Joakim O. Blanch	1391-26700	9923

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EXAMINER

LE, TOAN M

ART UNIT	PAPER NUMBER
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2862

DATE MAILED: 02/27/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/056,747

Applicant(s)

BLANCH ET AL.

Examiner

Toan M Le

Art Unit

2862

-- **Th MAILING DATE of this communication app ars on th cov r sheet with th corr spondenc address --**
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 January 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) 12-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11 and 21-28 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2. 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

- I. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. **Claims 1-11 and 21-28**, drawn to measurement system in a specific environment related to velocity of seismic wave, classified in **class 702, subclass 18**.
 - II. **Claims 12-20**, drawn to measurement system in a specific environment related to well logging or borehole study, classified in **class 702, subclass 6**.
2. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.
3. Because these inventions are distinct for the reasons given above and the search required for Group **I** is not required for Group **II**, restriction for examination purposes as indicated is proper.
4. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.
5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

6. During a telephone conversation with Mark Scott on 2/20/03 a provisional election was made with traverse to prosecute the invention of **I, claims 1-11 and 21-28**. Affirmation of this election must be made by applicant in replying to this Office action. **Claims 12-20** are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1, 8-9, and 27 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Referring to claim 1, in lines 9-10, “a plurality of component functions”, it is not clear pointing out what the component functions are.

As to claim 1, in line 11, “removing at least one component function to create a subspace”, it is not clear what the subspace is.

Referring to claims 8 and 27, “calculating an objective function using substantially the following equation: $1/|N_f W_f|^2$ where N_f is the subspace and W_f is the test vector, it is not clear $1/|N_f W_f|^2$ equals to what.

As to claim 9, in line 5, “x” should read -r-.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 1-11 are rejected under 35 U.S.C. 102(a) as being anticipated by Kimball.

Referring to claim 1, Kimball discloses in a system for acoustic logging of an earth formation comprising a transmitter creating acoustic energy and a plurality of receivers recording time domain representations of the acoustic energy as it traverses the earth formation, a method of signal processing to determine acoustic velocity as a function of frequency comprising: converting the time domain representations of the acoustic energy into frequency domain representations; creating a correlation matrix from amplitudes within the frequency domain representations at corresponding frequencies; finding an orthogonal basis of the correlation matrix comprising a plurality of component functions; removing at least one component function to create a subspace; and multiplying a test vector and the subspace, the test vector based on an estimated acoustic velocity of the earth formation, to determine whether the estimated acoustic velocity substantially matches the actual earth formation acoustic velocity (abstract; col. 14, lines 12-38; and col. 15, lines 3-8).

As to claim 2, Kimball discloses in a system for acoustic logging of an earth formation comprising a transmitter creating acoustic energy and a plurality of receivers recording time domain representations of the acoustic energy as it traverses the earth formation, a method of signal processing to determine acoustic velocity as a function of frequency, wherein converting

the time domain representations of the acoustic energy into frequency domain representations further comprises Fourier transforming each time domain representation to create each frequency domain representation (col. 7, lines 30-38; figure 5A, step 715).

Referring to claim 3, Kimball discloses in a system for acoustic logging of an earth formation comprising a transmitter creating acoustic energy and a plurality of receivers recording time domain representations of the acoustic energy as it traverses the earth formation, a method of signal processing to determine acoustic velocity as a function of frequency, wherein finding an orthogonal basis of the correlation matrix comprising a plurality of component functions further comprises determining eigenvectors and eigenvalues of the correlation matrix (col. 14, lines 25-27).

As to claims 4-7, Kimball discloses in a system for acoustic logging of an earth formation comprising a transmitter creating acoustic energy and a plurality of receivers recording time domain representations of the acoustic energy as it traverses the earth formation, a method of signal processing to determine acoustic velocity as a function of frequency, wherein removing a component function to create a subspace further comprises removing a higher order eigenvectors and a plurality of higher order eigenvectors corresponding to received acoustic energy related to the acoustic energy created by the transmitter, a lower order eigenvector and a plurality of lower order eigenvectors corresponding to received noise (col. 14, lines 28-31).

Referring to claims 8-9, Kimball discloses in a system for acoustic logging of an earth formation comprising a transmitter creating acoustic energy and a plurality of receivers recording time domain representations of the acoustic energy as it traverses the earth formation, a method of signal processing to determine acoustic velocity as a function of frequency, wherein

multiplying a test vector and the subspace to determine whether the estimated acoustic velocity substantially matches the actual earth formation acoustic velocity further comprises calculating an objective function using substantially the following equation: $1/|N_r W_r|^2$ where N_r is the subspace and $W_r = [1 \ e^{-jds} \ e^{-j2ds} \ e^{-j3ds} \ \dots \ e^{-j(n-r)ds}]$ is the test vector, where d is the distance between the receivers, s is the estimated acoustic velocity, n is the total number of received signals and r is the number of removed eigenvectors (equations 24 and 26; figure 5B).

As to claims 10-11, Kimball discloses in a system for acoustic logging of an earth formation comprising a transmitter creating acoustic energy and a plurality of receivers recording time domain representations of the acoustic energy as it traverses the earth formation, a method of signal processing to determine acoustic velocity as a function of frequency further comprising repeating the multiplying step for a plurality of test vectors comprising a plurality of estimated acoustic velocities and repeating the creating, finding, removing, multiplying steps for a plurality of corresponding frequencies (col. 14, lines 35-38).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 21-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimball.

Referring to claims 21-28, Kimball discloses a method of determining acoustic velocity and frequency dispersion of an earth formation using an acoustic tool including an acoustic transmitter with four acoustic receivers (figure 2), the method comprising: a) sending acoustic energy into the earth formation from the acoustic tool; b) detecting the acoustic energy in the earth formation at a plurality of receiver locations on the acoustic tool; c) creating time series representations of the acoustic energy in the earth formation for each of the plurality of receiver locations; d) Fourier transforming each of the time series representations to create a plurality of frequency domain representations; e) creating a vector from values at a selected frequency in each of the plurality of frequency domain representations; f) creating a correlation matrix from the vector; g) determining the eigenvectors and eigenvalues of the correlation matrix; h) removing at least one of the eigenvectors thereby creating a subspace; i) determining a value that is indicative of the extent a test may be represented by the subspace, and wherein the test vector is based on an estimated acoustic velocity of the earth formation; j) plotting the value as a function of the estimated acoustic velocity of the earth formation and the selected time series; k) repeating steps i) and j) for a plurality of estimated acoustic velocities; and l) repeating step e) through k) for a plurality of selected frequencies, wherein step a) further comprises sending acoustic energy into the earth formation at a depth level of interest and repeating steps a) through l) for a plurality of depth level of interest, wherein step h) further comprises removing at least one higher order eigenvector corresponding to desired acoustic signals and the remaining eigenvectors corresponding to noise, wherein step i) further comprises applying a test vector to the subspace with the result of the applying being the value indicative of the extent the test vector may be represented by remaining eigenvectors corresponding to noise following the

equation: $1/|N_r W_r|^2$ where N_r is the subspace and $W_r = [1 e^{-jds} e^{-j2ds} e^{-j3ds} \dots e^{-j(n-r)ds}]$ is the test vector, where d is the distance between the receivers, s is the estimated acoustic velocity, n is the total number of received signals and r is the number of removed eigenvectors (abstract; col. 14, lines 12-38; and col. 15, lines 3-8; equations 24 and 26; figures 5B and 11-12).

Kimball does not show plotting the value as a function of the estimated acoustic velocity of the earth formation and the selected frequency.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have plotted the value as a function of the estimated acoustic velocity of the earth formation with either the selected frequency or time series for a comparison between time series domain and frequency domain to improve an estimation of acoustic velocity and frequency dispersion of an earth formation.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent No. 6,418,381 to Fuller

U.S. Patent No. 5,808,963 to Esmeroy

These Patents disclose acoustic signal processing for determining acoustic velocity and frequency dispersion.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toan M Le whose telephone number is (703)305-4016. The examiner can normally be reached on Monday through Friday from 9:00 A.M. to 5:30 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Lefkowitz can be reached on (703)305-4816. The fax phone numbers for the


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organization where this application or proceeding is assigned are (703)872-9318 for regular communications and (703)872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)305-0956.

Toan Le

February 21, 2003


EDWARD LEFKOWITZ
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800